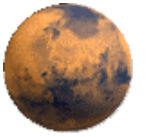


# Recruiting Pitch for the MSL Technology Infusion Task

James Kurien, Mark Drummond,  
Michael Freed, Anthony Barrett, Sven Grenander,  
George Stebbins, ...

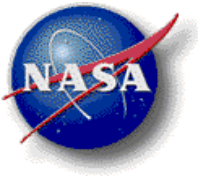
**Jet Propulsion Laboratory**  
**NASA Ames Research Center**





# Questions to Answer

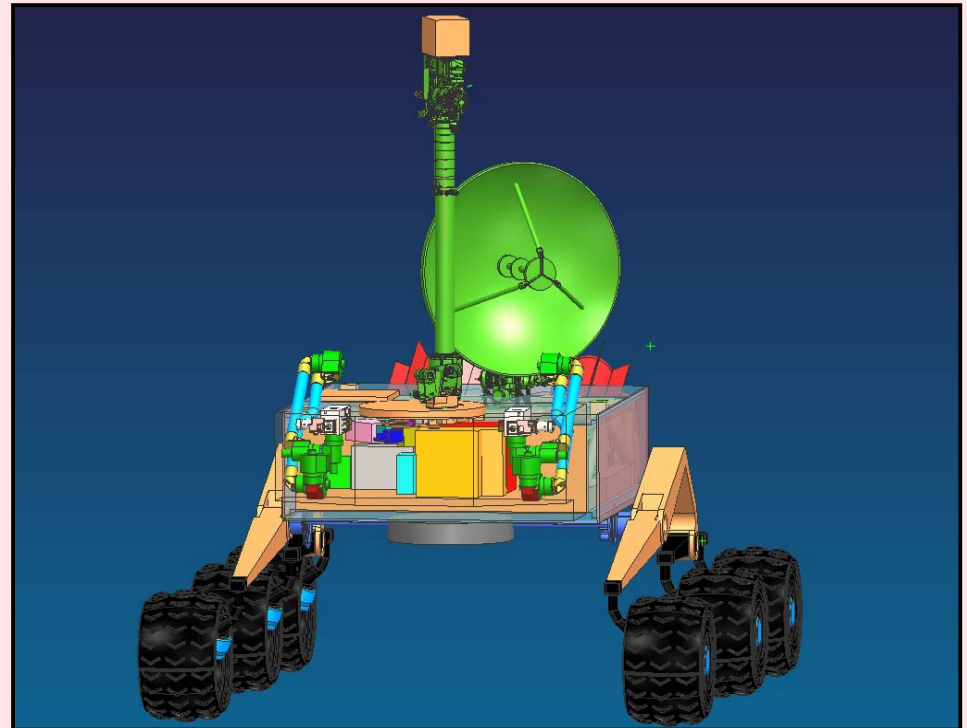
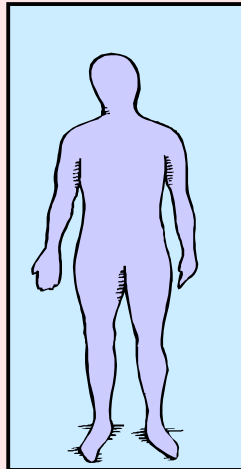
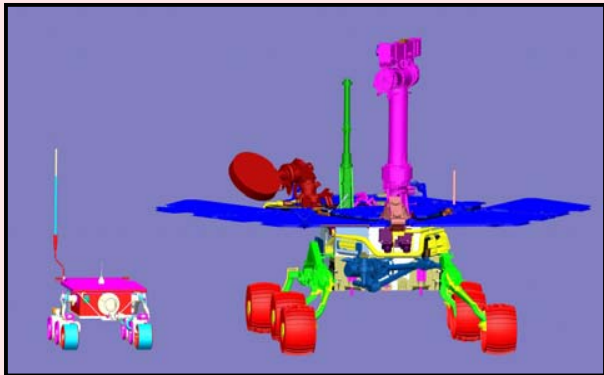
- Why are MSL and the infusion task so cool?
- What are we working on?
- What are the constraints on getting involved?
- How do you get involved?



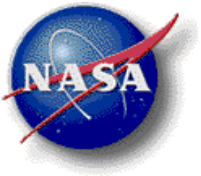
# Reason #1) MSL is huge



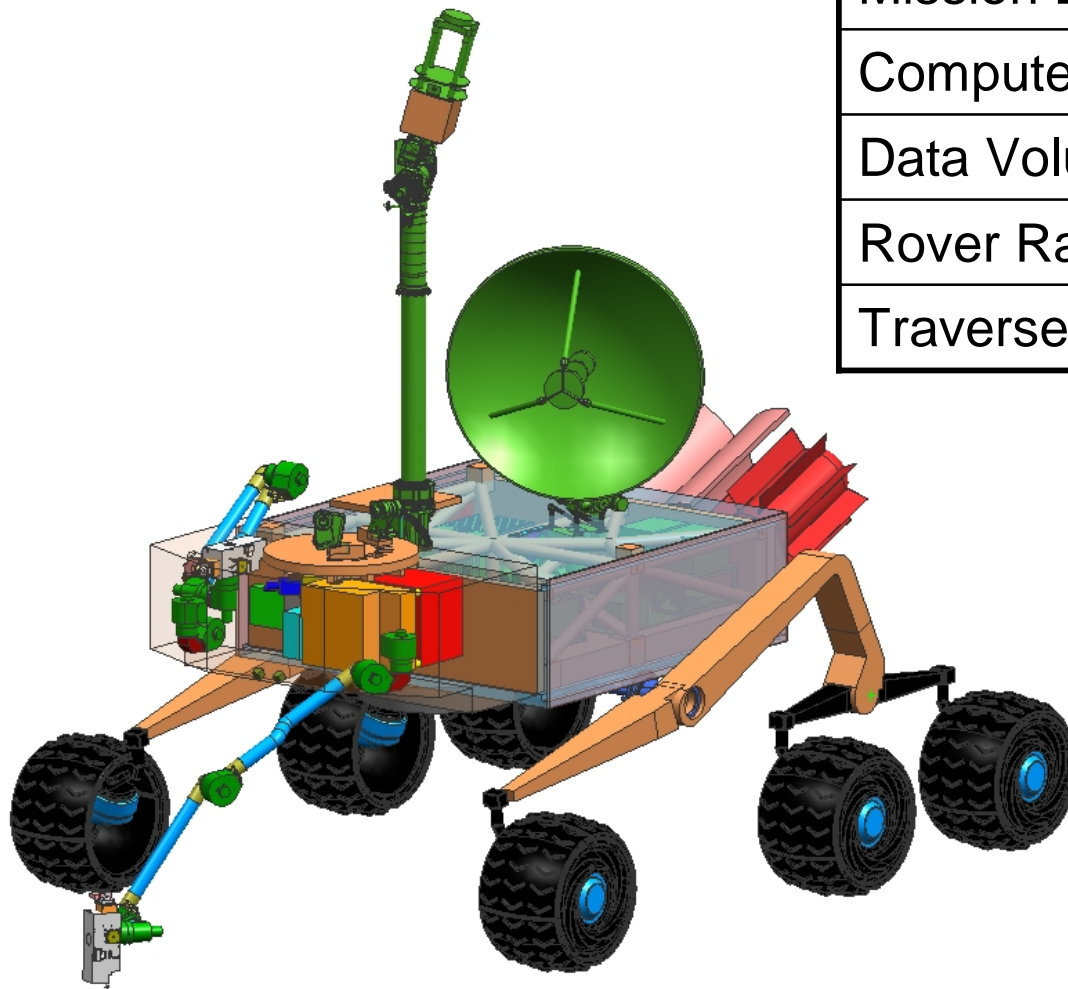
900 kg rover baseline  
112 kg instruments & support  
Two arms



*PRE-DECISIONAL DRAFT; For planning and discussion purposes only. Relative sizes are approximate*

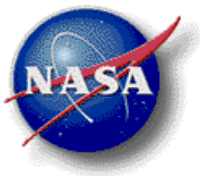


# Reason #2) It's nuclear\*

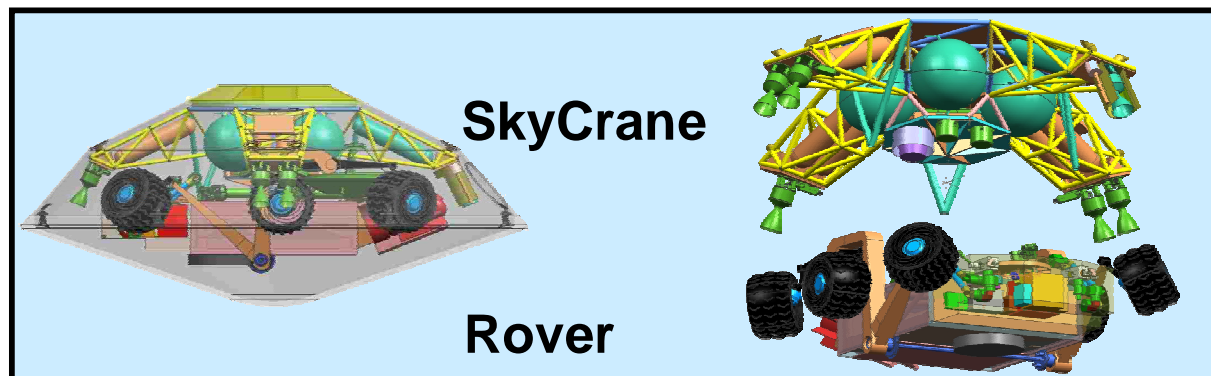


Mission Duration	687 days
Compute Power	>200 MIPS
Data Volume/Sol	>1000 Mbits
Rover Range	> 6 km
Traverse Robustness	High

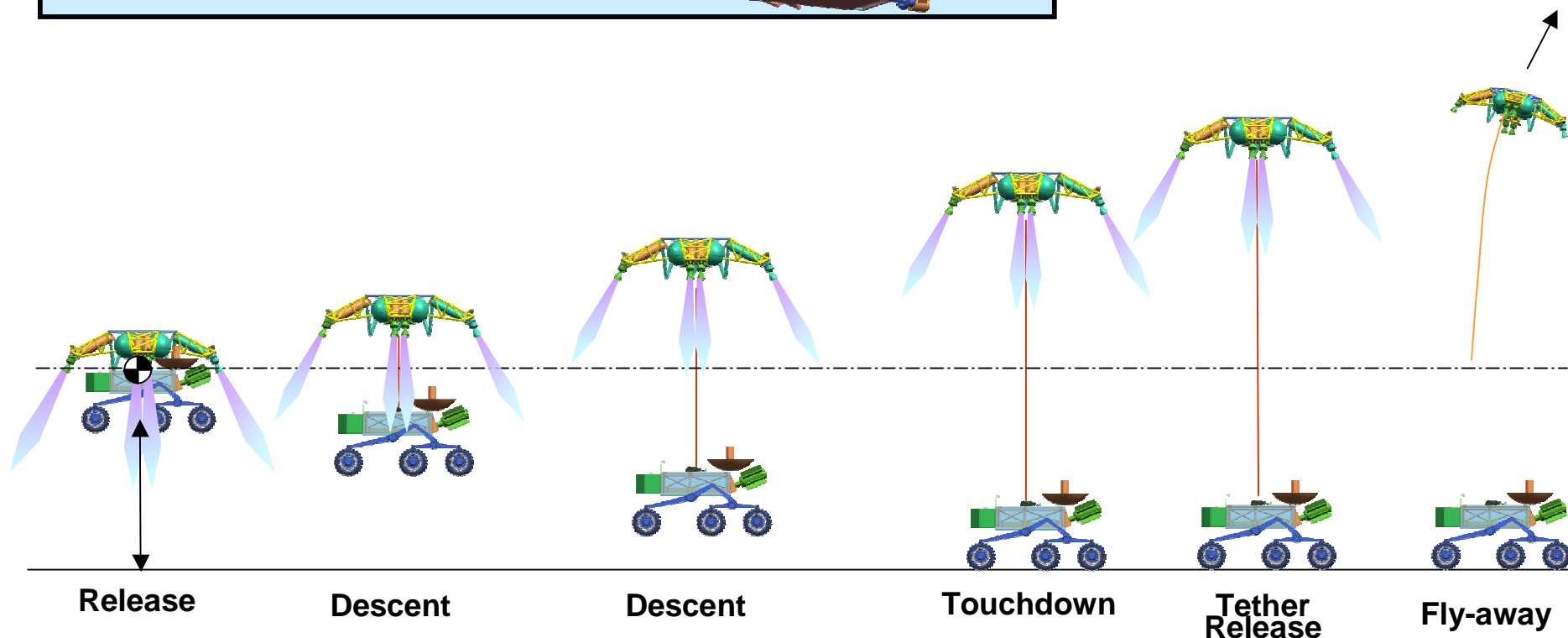
*\*PRE-DECISIONAL DRAFT;  
For planning and discussion purposes only*

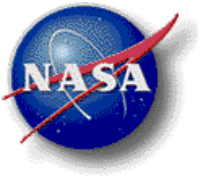


# Reason #3) The SkyCrane

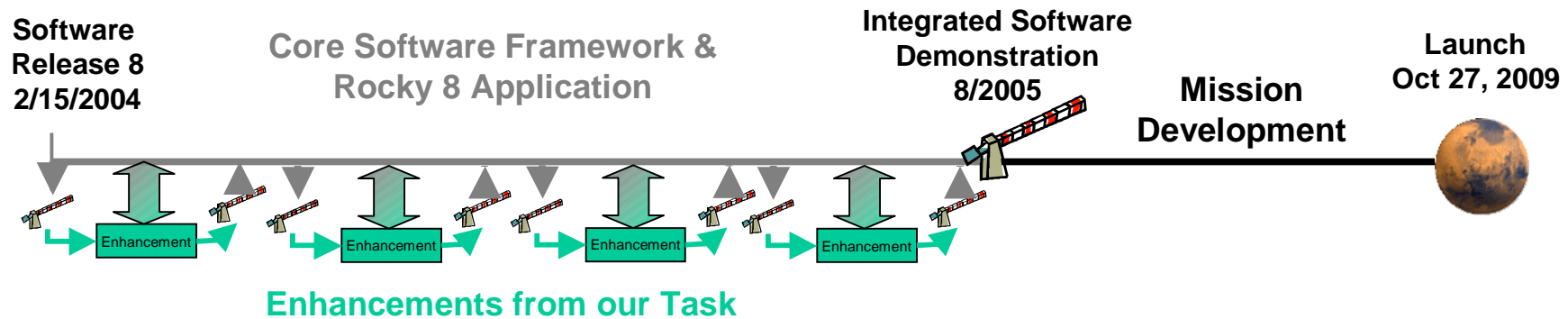


*PRE-DECISIONAL DRAFT;  
For planning and discussion  
purposes only*

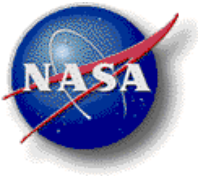




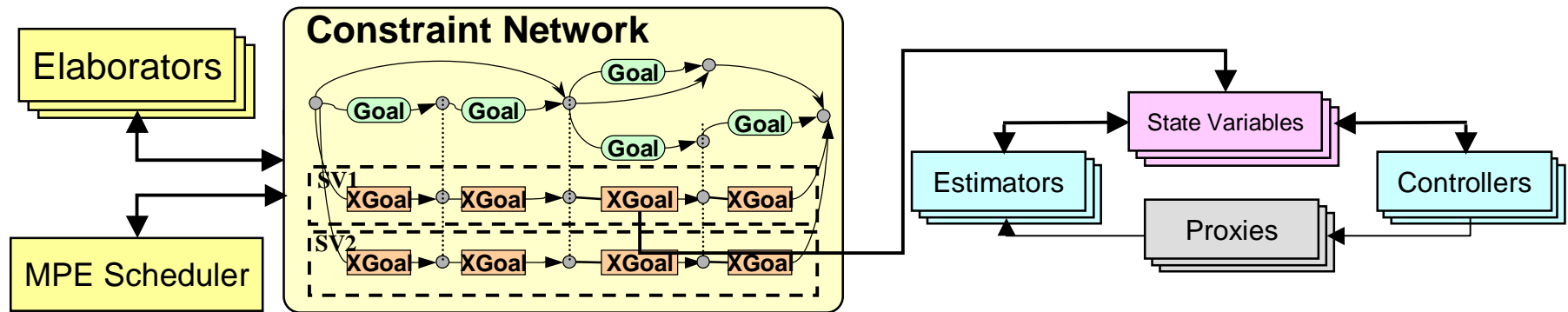
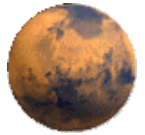
# Reason #4) It's happening now



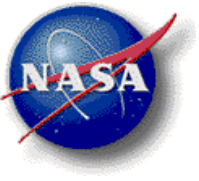
- We have a mission-driven set of enhancement areas
- We have 3 month release cycles starting 2/15/2005
- We are seen as part of the team
- We are expected to start contributing now



# Reason #5) It's what we like to do

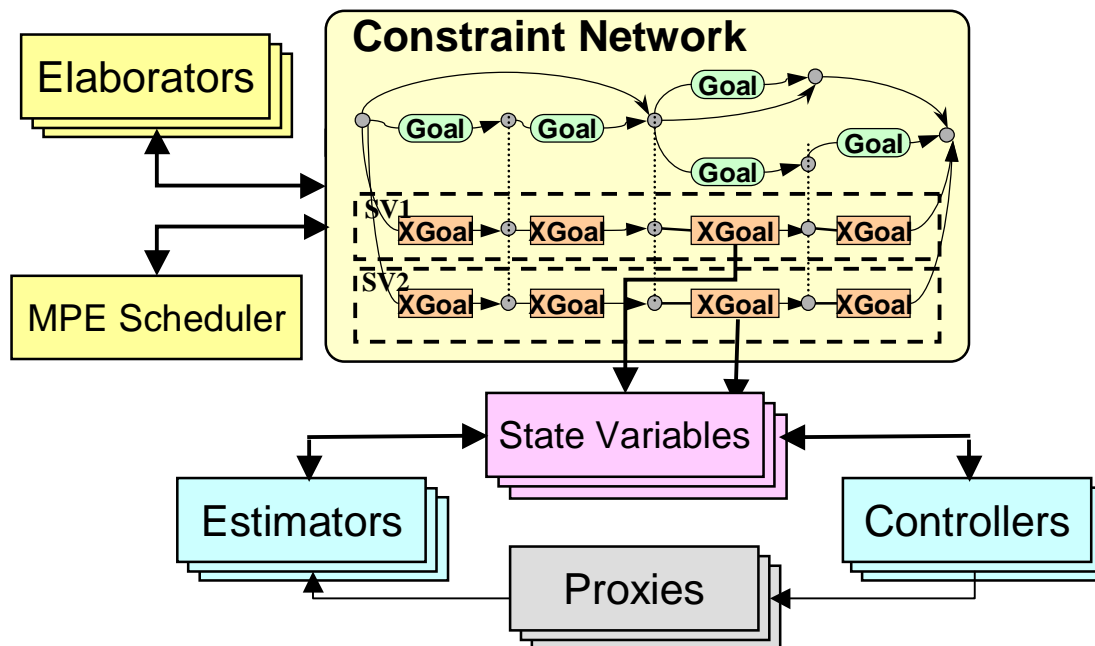


- Based on explicit representation of state, influence
- Familiar planning (elaboration) and scheduling concepts
- Different and mission-informed enough to be interesting
- MDS draws on Remote Agent lessons
- Partnered with JPL Division 36



# What are we working on?

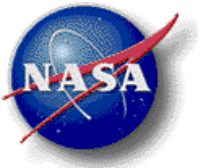
- Identify and remedy threats to the MPE meeting mission requirements.
- Identify and develop valuable MPE capabilities not on the core schedule.



## Interesting Questions

- How do we quickly schedule as many constraints as possible?
- How do we detect why a constraint failed?
- What do we do about it?
- How can we make the constraints flexible to the environment?
- Which of two constraint sets is more likely to succeed in a stochastic environment?





# Specific Enhancement Areas



## 1. MPE performance improvement:

“Develop the same goal nets and schedules, only faster”

- Scalability analysis of elaboration, scheduling, time point execution
- Development of appropriate algorithmic modifications or replacements

## 2. More flexible elaboration and execution:

“Avoid failing at run time by being flexible”

- Introduce a notion of flexible plans, with minimal impact on resource computation and execution
- Represent events of uncertain duration, schedule and execute relative to their completion

## 3. Informed response to goal-net failure:

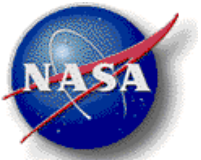
“If you can’t avoid failure, respond to it well”

- Develop simple methods for classifying goal-net failure
- Provide rescheduling and re-elaboration methods to respond
- Guide elaboration with information from scheduling and execution

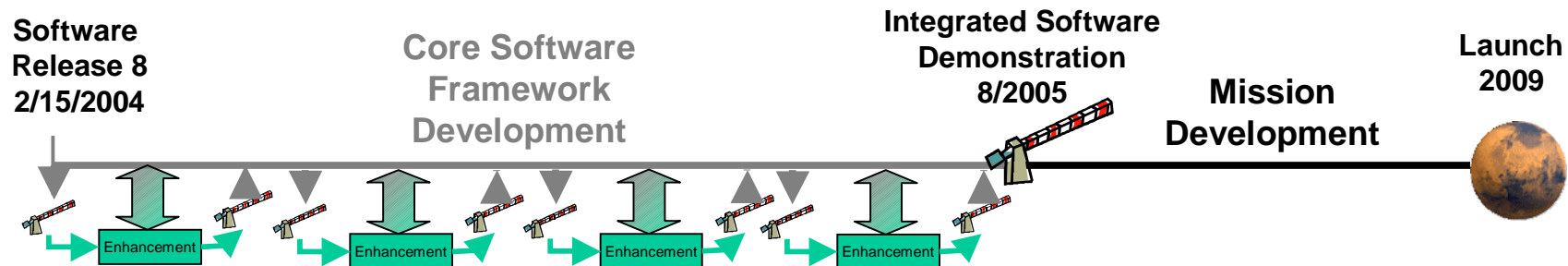
## 4. Uncertainty-based evaluation of goal nets

“Estimate the likelihood of success and help the operator evaluate and choose goal nets”

- Characterize expected performance of goal net via analysis or simulation over a variety of contingencies
- Develop measures to compare two goal nets’ expected performance



# Specific Enhancement Techniques



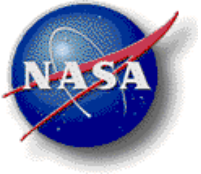
## Some Areas of Interest

- Scheduling
- Fast constraint propagation
- Execution of flexible plans
- Fault isolation and response
- Anytime and contract algorithms
- Reactive plan or schedule repair
- Monte Carlo plan analysis

## Types of Contribution

With examples from the scheduling domain

- Risk Reduction  
Early analysis of core scheduling algorithms to judge scalability to flight-sized problems
- Technology Infusion  
Integration of state of the art or state of the practice techniques for fast resource scheduling
- Technology Scouting  
Evaluation of added functionality such as anytime scheduling or scheduling conditional plans



# Getting Involved

## Constraints

- This is a focused, mission driven task
- Travel to JPL will be required
- C++ and MDS development required\*

## Current ARC Team

- Mark Drummond 80%
- James Kurien 100%
- Mike Freed 50%
- Ari Jonsson 25%
- Planned Thinkbank involvement

## Contacts

James Kurien  
kurien@email.arc.nasa.gov  
x4-1685

Mark Drummond  
mdrummond@mail.arc.nasa.gov  
x4-1965